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SUGGESTIONS FOR WEEDING IN NORTHERN HARDWOODS

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No. 1	"Forestry Work for Unemployment Relief" by Victor S. Jensen	February 8, 1933
No. 2	"Northeastern Forest Experiment Station Surveys its First Ten Years" by C. Edward Behre	June 15, 1933

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The northern hardwood type is one of the most extensive and commercially one of the most important forest types in the Northeast. The present poor condition of the stands and recently cut-over areas in this type is the result of extensive cutting operations in which the succeeding crops were given no consideration, or if provisions were made for the succeeding crop the stand did not develop as anticipated. Due to the large proportion of undesirable trees which occur on most cut-over areas in this type, a weeding operation is necessary to secure a desirable stand as this will increase the proportion of desirable species in a stand, stimulate the growth, and improve the quality of the residual stand.

Classification of Stems

In any weeding operation the saplings fall in three classes; crop trees which will be favored in the cultural operation; weed trees that are retarding the development of the crop trees and which should be eliminated; and trainers which make up the remainder of the stand and should remain at least temporarily to crowd the crop trees from the side and insure a final stand of well formed, clean boled trees. Men inexperienced in this type of work have a tendency to select too many trees for cutting that might better serve as trainers. The less desirable trees ordinarily classified as weed species are not necessarily weed trees in this type of cutting. Position in the stand in relation to the crop tree is the primary consideration; individual white ash and sugar maple trees might be cut as weeds while pin cherry and striped maple may serve as trainers.

Selection of Crop Trees

In selecting the crop trees, there are a number of important considerations. In northern hardwood stands, the most desirable species are white ash, sugar maple, paper birch, yellow birch, basswood, black cherry, red spruce, balsam fir, and hemlock. Beech, red maple, and aspen are less desirable than the above, altho they should be favored in the stand in preference to gray birch, pin cherry, striped maple, and mountain maple. Single stemmed saplings should ordinarily be given preference, particularly those of seed or seedling sprout origin; sprouts from stumps more than 2 inches in diameter should never be favored as crop trees. The prospective

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crop trees (except tolerant conifers) should be of average or slightly above average height. Trees less than average height are likely to have underdeveloped crowns and root systems, and consequently have difficulty in surviving in competition with the surrounding growth. Saplings too far above the average height should be eliminated as they will develop into wolf trees. If available, crop trees should be selected at 12 to 18 foot intervals; unfortunately desirable saplings are not always well distributed, a condition which may be partially overcome by a closer grouping of the crop trees bordering the poorer sections of the stand. On some areas a sufficient number of the more desirable individuals may be developing satisfactorily and an expense for weeding may not be justified. On other areas the stand in spite of any practicable treatment will probably have little commercial value, except possibly for fuelwood. It is doubtful whether treatment of areas supporting only such borderline species as beech and red maple will justify the expense of cultural work.

When to Weed

In order to obtain the best results in northern hardwood stands, weeding operations should be carefully timed, for if undertaken when the trees are beginning to assert their dominance and before competition becomes too keen, the minimum expense will insure the maximum benefits. Weeding should be delayed until there is a differentiation into crown classes and it is possible to tell which saplings give promise of the best development; but if weeding is postponed too long some of the potential crop trees will be underdeveloped or dead as a result of competition with weed species and in other cases the differentiation in heights will be so pronounced that individuals which otherwise might have made up the final crop must be cut to prevent their development into wolf trees. On good sites weeding operations will necessarily be made at a shorter interval following logging operations than on the poorer sites. Ordinarily the first weeding should be made 5 to 10 years after logging; on some areas a second weeding 5 to 10 years later may be necessary to insure the highest returns. In order to readily identify the species, weeding in northern hardwood stands can best be carried on when the foliage is on the trees. If the weeding is carried on in late summer the resulting sprout growth will probably be less vigorous than if carried on in the spring or early summer months.

Composition and Character of Stands to be Weeded

In selecting an area to carry on weeding experiments, the Bartlett Experimental Forest offered an opportunity to work on cut-over areas of different ages as annual fuelwood sales have been made in hardwood stands on this tract for the past twenty years. With the exception of some of the more recent sales, the areas were marked for cutting by the local ranger who reserved the softwoods and better hardwoods. As a result of this marking practice the residual stands on areas classified as cut-over were very irregular; small areas were clearcut while on others none of the trees were removed. Table I

and Figure 1 give an indication of the average stand of reproduction and smaller size classes on 180 acres cut-over from two to twelve years previously and allowed to develop without subsequent treatment.

By comparing conditions in the two age groups in Table I and Figure 1 it would appear that if the reproduction is allowed to develop without treatment there is an increase varying from 1 to 18 percent in the proportion of stems in the four larger size classes, altho there are about 30 percent fewer stems of all size classes on areas cut-over from 8 to 12 years before the inventory than on the 3 to 7 year cuttings. As brought out by Table I, the proportion of valuable species of all the size classes is slightly lower in the older age groups except the .6" to 1.5" D.B.H. class, which shows a proportionate increase of about 7 percent. If allowed to develop without cultural treatment, the proportion of valuable species on this area will probably continue to decrease as the fast growing beech and red maple sprouts will eventually dominate the stand. The worthless species (pin cherry and striped maple) are relatively more important in the older age groups, but this is only of minor significance as they are shortlived and will give way to other species as the stand develops. In both age groups the valuable species occur in sufficient numbers to justify a weeding operation.

The stands on the Bartlett Experimental Forest are no more favorable for a weeding operation than the average cut-over areas in northern hardwood stands of the region. A comparison of stands on areas examined at Bartlett with five areas cut-over from 1927 to 1931 and later examined by A. C. Van Nort and forest rangers on the White Mountain National Forest, would indicate that on the Bartlett Experimental Forest the proportion of desirable species, particularly sugar maple, is well below average for the White Mountains.* Beech, which is not a particularly desirable species, occurs in much greater numbers at Bartlett than on any of the other areas examined on the White Mountain National Forest.

Analysis of Weeding

In 1932, 1933, and 1934, intensive plots were established on cut-over areas of the Bartlett Experimental Forest in order to determine the practicability of weeding operations which would increase the proportion of desirable trees in the final crop. Tables II, III, IV, and V combine the data obtained in two age groups; cut-over 4 to 8 years and cut-over 9 to 13 years previously. In each age group two degrees of cutting were applied; a heavy weeding in which all trees retarding the development of the crop trees were cut, and a light cutting in which only saplings overtopping the crop trees were cut.

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* Van Nort, A. C. Reports on Initial Examinations of Wheeler Brook, Batchelder Brook, Peaked Hill, A. G. Hall, and Peabody Fuelwood Cut-over Areas.

Tables II to V, in which crop trees are classified according to D.B.H. and species, include only trees benefited by treatment. In addition, the stands contain a considerable number of crop trees which do not require releasing; approximately 15 percent on the heavily cut areas and 20 percent on the light weeding plots. Included in the 15 or 20 percent are a considerable number of the desirable species in the larger size classes. Other large trees of the better species were not considered desirable for the final crop.

Approximately the same number of crop trees were benefited in the several different types of weeding operations. The irregular distribution of species and size classes indicated in a comparison of the various tables is partially due to the small samples which were the basis for Tables II, III, and IV. The average number of weed trees cut and trainers reserved in the several zones within a 6' radius of the crop trees, as shown in Tables II to V and Figure 2, gives an indication of the treatment on the areas surrounding crop trees, but slightly exaggerates the number of trees that would necessarily be cut for each reserved tree as there was a certain amount of duplicate tallying where crop trees occurred less than 12' apart.

It is apparent that the average number of stems surrounding each crop tree was about 25 percent higher on the more recently cut-over areas; otherwise the stands on the several series of sample plots were very uniform. Approximately three times as many weed trees were cut on a heavy as compared with a light weeding operation, and in all cases proportionately more stems were cut close to the crop trees (0 to 2' zone), as the area of the 2' to 4' zone is three times as great and the 4' to 6' zone five times as great as the 0 to 2' zone.

On the intensive weeding plots the areas cut-over 4 to 8 years previously required an average of 4 and 5 man hours per acre respectively on the light and heavy cuttings, while light and heavy weedings required 3 and 4½ hours on the 9 to 13 year cut-over areas. The time required for light cuttings was naturally lower than heavy cuttings as fewer stems were cut. The heavy and light weedings required slightly less time in the older than the younger stands, for altho the average size was larger, it was necessary to cut a smaller number of stems. The time required on these plots is low as the trees to be removed were marked prior to the weeding operation; a desirable practice which would be impractical on extensive operations. A moderately heavy cutting on a 110 acre stand similar to the sample plots required an average of 9.5 man hours per acre with C.C.C. labor, a figure more nearly what might be expected on an extensive operation in similar stands. In comparing the various methods of cutting which were tried on these plots, other factors far outweighed the slight advantage in favor of high stumps or partially severing the stems, as opposed to low stumps.

Organization of Crew

In organizing a crew to carry on a weeding operation, there are several important considerations. Adequate instructions, explanations, and examples of the proper procedure should precede the actual cutting. A crew of 3 or 4 men under the close supervision of an experienced, technically trained man should become thoroly familiar with the work, after which the crew may be gradually built up to a maximum of 8 to 10 men. When the men become thoroly familiar with this type of work, additional crews may be built up from this nucleus. Some of the men trained will be qualified to act as sub-foremen in charge of independent crews. One technical foreman will be able to handle the supervision of several small independent crews, each in charge of a sub-foreman, and this will prove more satisfactory than attempting to use a single large crew. The cost of supervision will be relatively high on a weeding operation, particularly while the work is being organized. The weeding costs per acre will be greatly reduced if the crew members are carefully selected and the turnover is held to the minimum.

The tendency to over-cut is a common fault of inexperienced men on this type of work; this results in higher costs per acre and usually injures rather than benefits the residual stand. Too much emphasis cannot be placed on the definition of weed trees which consist only of trees that are retarding the development of the crop trees.

In a systematic weeding operation the area can best be covered by a crew working diagonally abreast. If this plan is followed, the man working one of the end strips is responsible for the course, the man working the adjoining parallel strip stays a short distance behind, the third member of the crew lines in the same way on the second, the fourth on the third, etc. Ordinarily each man should be responsible for a strip about fifteen feet wide (the width of the strip depends on the type of growth), and except in irregular stands his work will be confined to this strip. The foreman or sub-foreman responsible for the job should work back and forth behind the men inspecting the work as it progresses, at the same time instructing and assisting members of the crew. As large, worthless trees which should be girdled usually occur on cut-over areas, at least one member of the weeding crew should carry an axe. In some cases the axeman will necessarily spend all of his time girdling.

The method of cutting and selection of the proper tools are important considerations in a weeding operation. The height of the stumps has little or no effect on the number and vitality of sprouts so the weed trees may be cut at any convenient height; about 15 inches if the stems are bent over when cut. Partial severing and bending or breaking over the tops is as effective as cutting; the resulting sprouts will probably be less vigorous than those growing from clean cut stumps. Skilled axemen may prefer and do more work

with a light axe or hatchet, but ordinarily a machete will prove the most effective tool. The scissor type pruner has advantages; skill is not required for effective use, and the residual stand will not be damaged in removing wood trees. These pruners also have their disadvantages as they are relatively expensive, occasionally get out of adjustment, are somewhat heavy and not well adapted for cutting large stems, and ordinarily prove less efficient than an axe or machete properly handled.

Conclusions

Weedings, particularly on the better sites and more accessible areas, should be given serious consideration in any intensive silvicultural improvement program in northern hardwoods. If suitable areas are selected and the work properly organized, the costs and benefits of weeding will probably compare favorably with other types of cultural work. On a considerable proportion of the recently cut-over hardwood areas a weeding operation is the only means of obtaining a stand, any considerable proportion of which would have a higher use than fuelwood.

TABLE I

Sapling Stand Per Acre on the Bartlett Experimental Forest, Cut-over Areas

Stand 3-7 Years after Cutting [1]

Size class	Total stand		Valuable species [3]		Secondary species [4]		Worthless species [5]	
	No. of stems	% size class	No. of stems	% size class	No. of stems	% size class	No. of stems	% size class
1'-3.9' H	8499	77.8	3209	37.8	4601	54.1	689	8.1
4'H-.5" D	1711	15.7	333	19.5	1044	61.0	334	19.5
0.6"-1.5"	578	5.3	55	9.5	467	80.8	56	9.7
1.6"-2.5"	76	0.7	34	44.7	42	55.3	0	0.0
2.6"-3.5"	53	0.5	25	47.2	28	52.8	0	0.0
Total	10917	100.0	3656	33.5	6182	56.6	1079	9.9

Stand 8-12 Years after Cutting [2]

Size class	Total stand		Valuable species [3]		Secondary species [4]		Worthless species [5]	
	No. of stems	% size class	No. of stems	% size class	No. of stems	% size class	No. of stems	% size class
1'-3.9' H	5838	53.6	2130	36.5	2926	50.1	782	13.4
4'H-.5" D	3732	34.3	647	17.3	2685	72.0	400	10.7
0.6"-1.5"	827	7.6	138	16.7	637	77.0	52	6.3
1.6"-2.5"	308	2.8	113	36.7	174	56.5	21	6.8
2.6"-3.5"	182	1.7	76	41.8	103	56.6	3	1.6
Total	10887	100.0	3104	28.5	6525	59.9	1258	11.6

1/ Based on 9 1/4 acre plots.
2/ " " 27 1/4 acre plots.
3/ Includes red spruce, balsam fir, hemlock, yellow birch, sugar maple, paper birch, white ash, black cherry.
4/ Includes beech, red maple, and aspen.
5/ " pin cherry, and striped maple.

TABLE II

Per Acre* Stand Tally of Crop Trees and Average Number of Trainers and Weed Trees on 4-8 Year Cut-over Areas, Bartlett, New Hampshire

Light Weeding

Crop Trees

DBH inches	White ash	Sugar maple	Yellow birch	Paper birch	Red spruce	Total
Smaller than BH					10	10
.2-.5	5		35	45	30	115
.6-1.0		15	15	30	15	75
1.1-1.3		15	5	5	5	30
Total	5	30	55	80	60	230

Trainers and Weed Trees

	Distance from Crop Trees			
	0-2'	2-4'	4-6'	Total
Average number trainers per crop tree	3.6	11.0	18.5	33.1
Average number weeds cut per crop tree	1.1	1.1	0.8	3.0
Total	4.7	12.1	19.3	36.1

*Based on two 1/10 acre plots.

TABLE III

Per Acre* Stand Tally of Crop Trees and Average Number of Trainers and Wood Trees on 4-8 Year Cut-over Areas, Bartlett, New Hampshire

Heavy Weeding

Crop Trees

DBH inches	Sugar maple	Yellow birch	Paper birch	Red spruce	Total
Smaller than BH				5	5
.2-.5	25	15	15	20	75
.6-1.0	70	10	15	15	110
1.1-1.4	10		5		15
Total	105	25	35	40	205

Trainers and Wood Trees

	Distance from Crop Trees			
	0-2'	2-4'	4-6'	Total
Average number of trainers per crop tree	2.1	8.7	15.1	25.9
Average number of woods cut per crop tree	3.1	3.4	2.5	9.0
Total	5.2	12.1	17.6	34.9

*Based on two 1/10 acre plots.

TABLE IV

Per Acre* Stand Tally of Crop Trees and Average Number of Trainers and Weed Trees on 9-13 Year Cut-over Areas, Bartlett, New Hampshire

Light Weeding

Crop Trees

DBH inches	White ash	Sugar maple	Yellow birch	Paper birch	Total
.2-.5	60	70	10	10	150
.6-1.0		50		30	80
Total	60	120	10	40	230

Trainers and Weed Trees

	Distance from Crop Trees			
	0-2'	2-4'	4-6'	Total
Average number of trainers per crop tree	3.1	9.7	13.8	26.6
Average number of weeds cut per crop tree	0.8	1.7	1.8	4.3
Total	3.9	11.4	15.6	30.9

*Based on one 1/10 acre plot.

TABLE V

Per Acre* Stand Tally of Crop Trees and Average Number of Trainers and Wood Trees on 9-13 Year Cut-over Areas, Bartlett, New Hampshire

Heavy Wooding

Crop Trees

DBH inches	White ash	Sugar maple	Yellow birch	Paper birch	Red spruce	Balsam fir	Total
Smaller than BH					3	1	4
.2-.5	25	11	3	5	5	1	50
.6-1.0	23	33	9	22	6		93
1.1-1.5	4	10	8	18	5	1	46
1.6-1.9	1	3	2	4			10
Total	53	57	22	49	19	3	203

Trainors and Wood Trees

	Distance from Crop Trees			
	0-2'	2-4'	4-6'	Total
Average number of trainors per crop tree	2.0	6.8	12.0	20.8
Average number of woods cut per crop tree	2.2	2.8	2.8	7.8
Total	4.2	9.6	14.8	28.6

*Based on 13 plots; total area 1.9 acres.

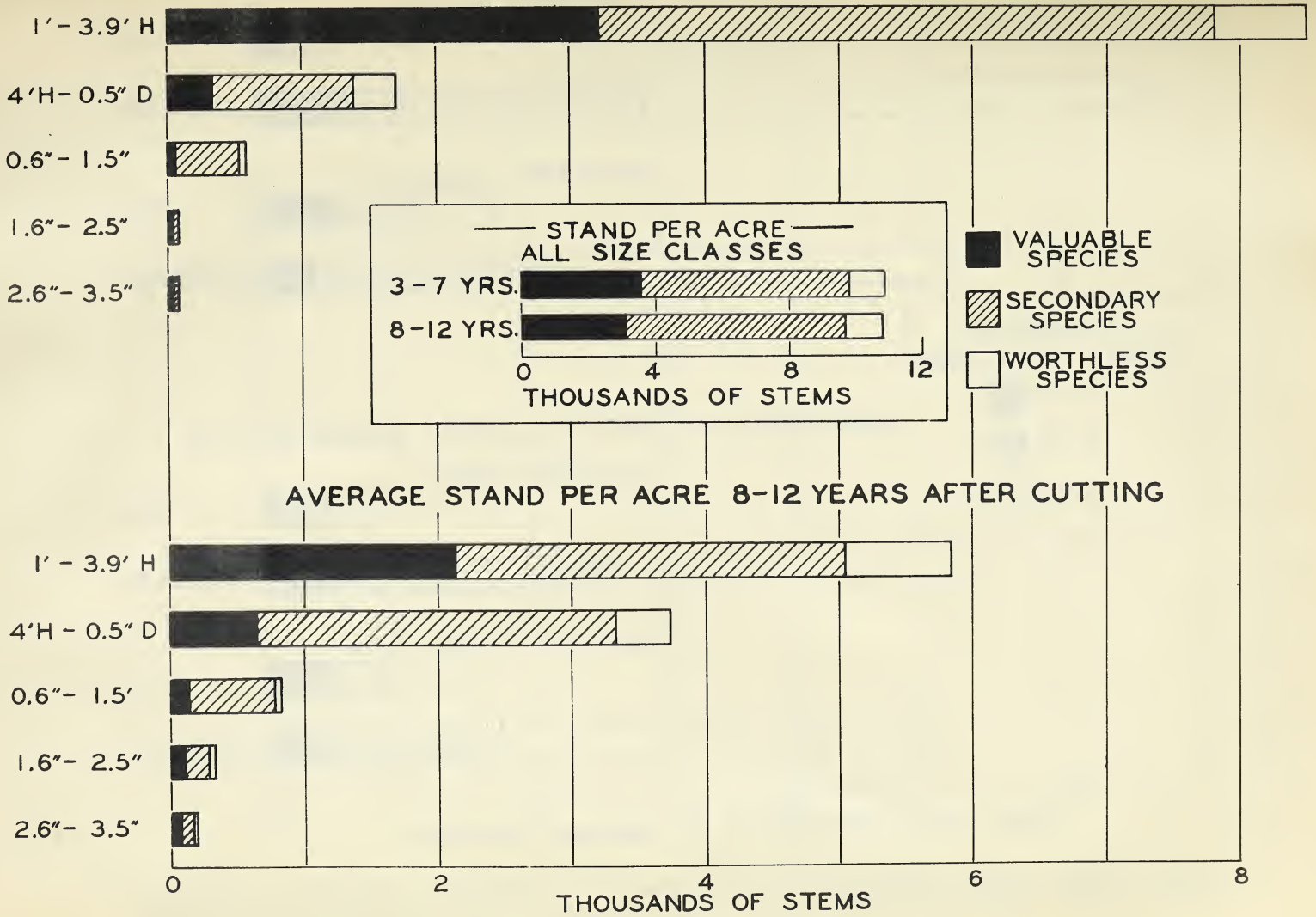

FIGURE 1- SAPLING STAND BY SIZE CLASSES ON THE BARTLETT EXPERIMENTAL FOREST.

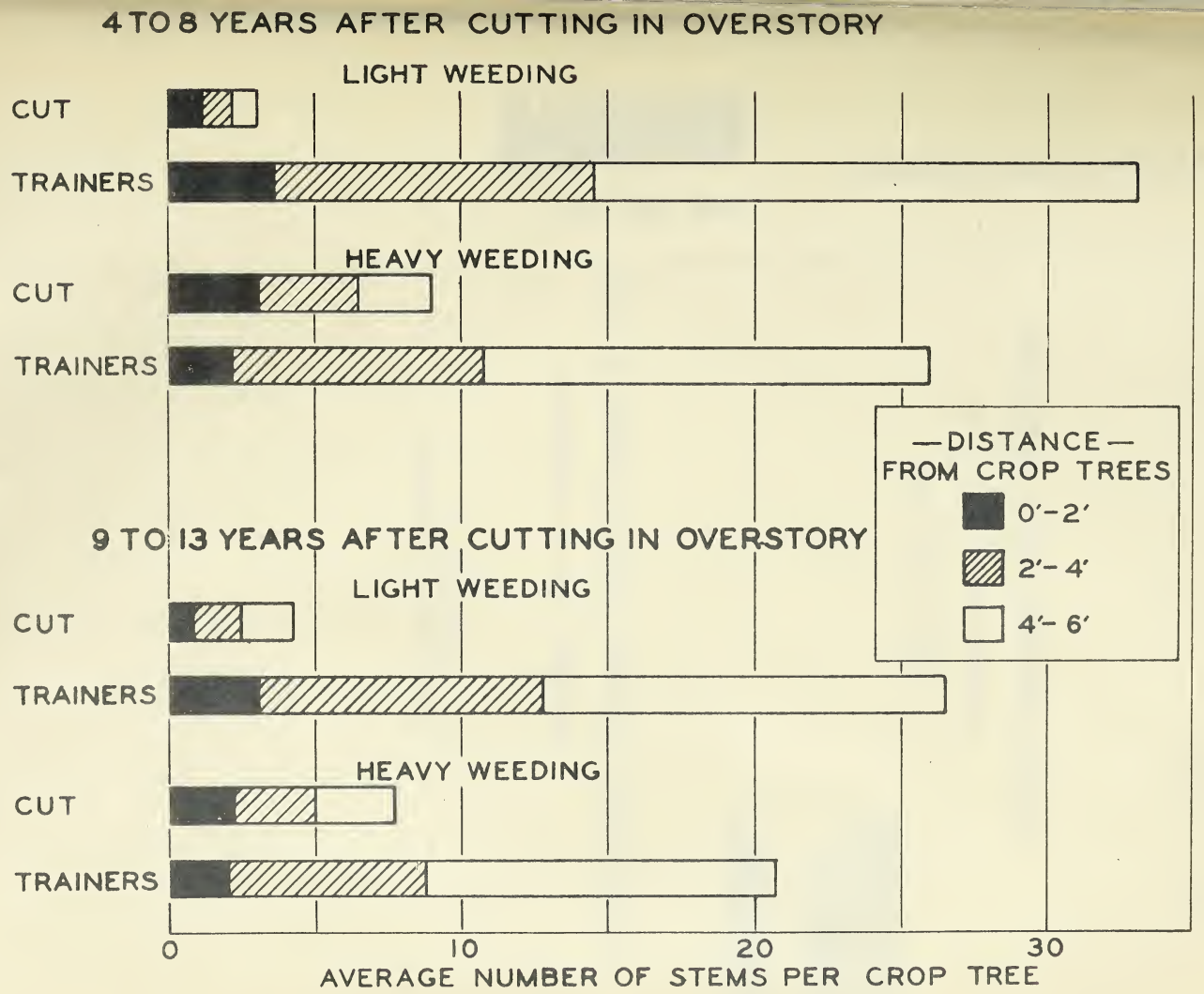

FIGURE 2– AVERAGE NUMBER OF STEMS CUT AND RESERVED NEAR CROP TREES ON INTENSIVE WEEDING PLOTS ESTABLISHED IN RECENTLY CUTOVER AREAS ON THE BARTLETT EXPERIMENTAL FOREST.